

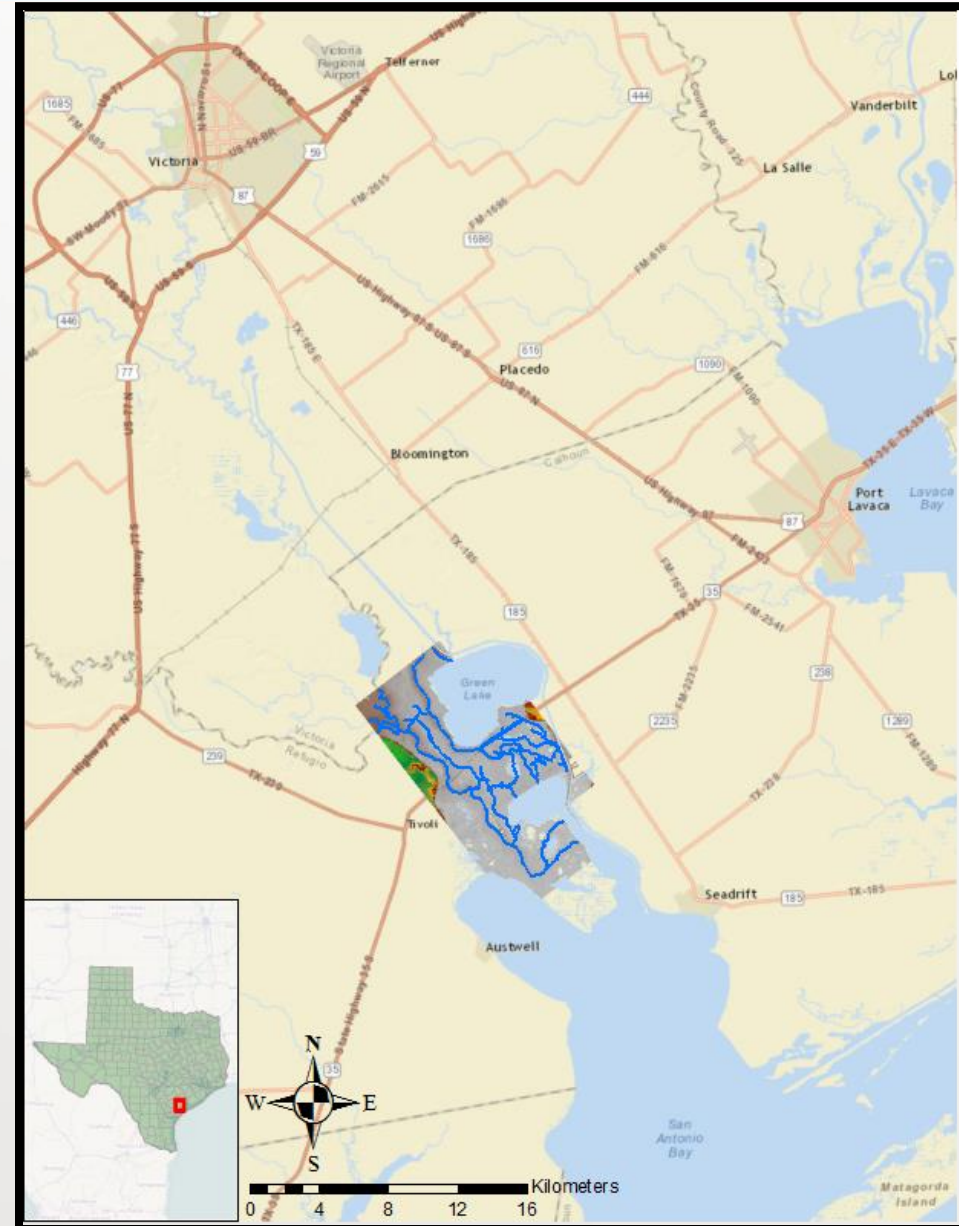
Guadalupe Delta and Estuary Bayou Flow



General Purpose

Improve the understanding of inflows from the Guadalupe River into San Antonio Bay via the river and local bayous through lidar analysis and numerical modeling

Special interest in understanding flows through 4 bayous within the Guadalupe Wildlife Management Area



Project Objectives

Task 1

Produce inundation maps to identify channel connectivity

Task 2

Perform field work to identify potential flow restrictions and install sensors

Task 3

Analyze system using Frehd model

(<http://www.cwrw.utexas.edu/hodges/frehd/>)

Task 1

Inundation maps establishing connectivity

Steps

- 1) Classify water feature returns from lidar dataset
- 2) Identify primary system channelization
- 3) Establish maps of current water surface elevations
- 4) “Inundate” channels by increasing current water depths at different intervals and map channel connectivities at different depths

Task 2

In field sensor installation and recovery

Steps

- 1) Identify likely sensor locations from lidar data and satellite imagery
- 2) Perform field reconnaissance to comprehend field conditions and determine sensor placement feasibility
- 3) Install water level loggers and CTD sensors
- 4) Recover sensors

Task 3

Modeling of system hydrodynamics using Frehd

Steps

- 1) Prepare DEM and special restriction data for Frehd model input
- 2) Calibrate and run model
- 3) Verify model with measured water conditions under historical forcings

WORK TO DATE

Task 1.1

“Known” water feature classification

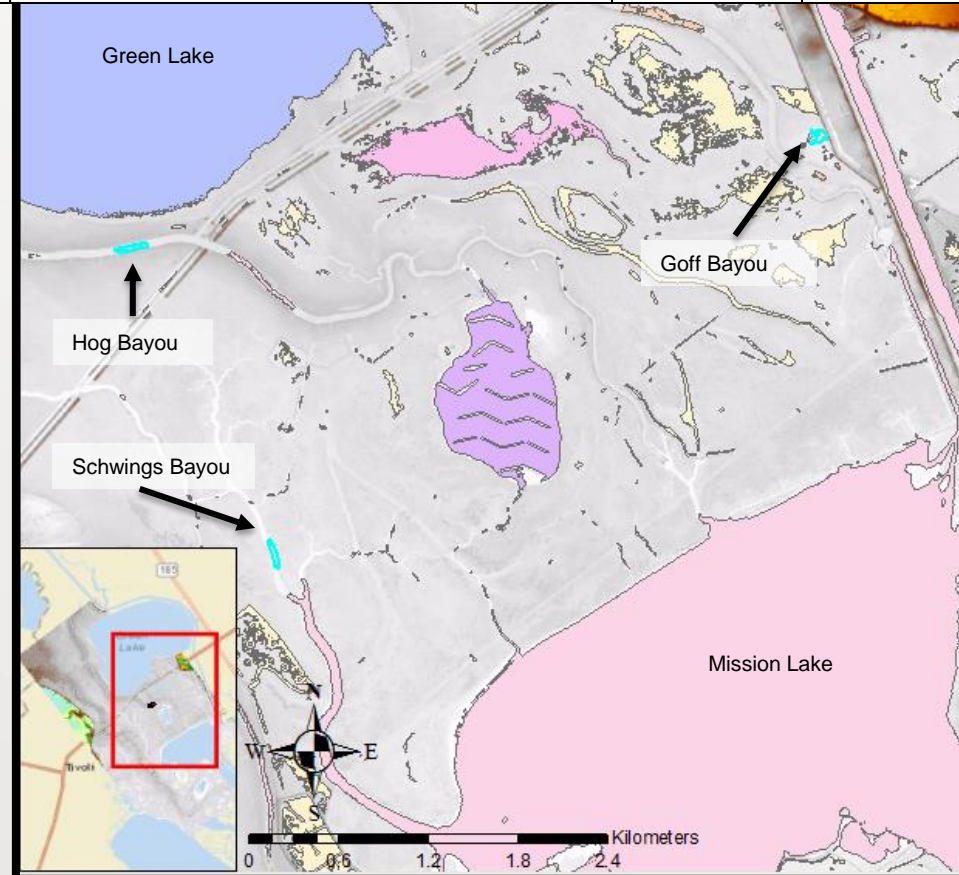
Water features identified by no return on lidar dataset, thus clearly present in dataset

Classified based on NHD Ftypes

Sizes, areas, and names (where available) also cataloged

OBJECTID *	Shape *	GNIS_ID	GNIS_Name	FType
1984	Polygon Z	1374086	Hog Bayou	StreamRiv
2438	Polygon Z	1384868	Schwings Bayou	StreamRiv
1420	Polygon Z	1373865	Goff Bayou	LakePond

OBJECTID *	FCode	Shape_Length	Shape_Area
1984	Stream/River: Hydrographic Category = Perennia	614.512223	5775.97676
2438	Stream/River: Hydrographic Category = Perennia	474.098212	5524.72718
1420	Lake/Pond: Hydrographic Category = Perennial	635.878328	5498.56842

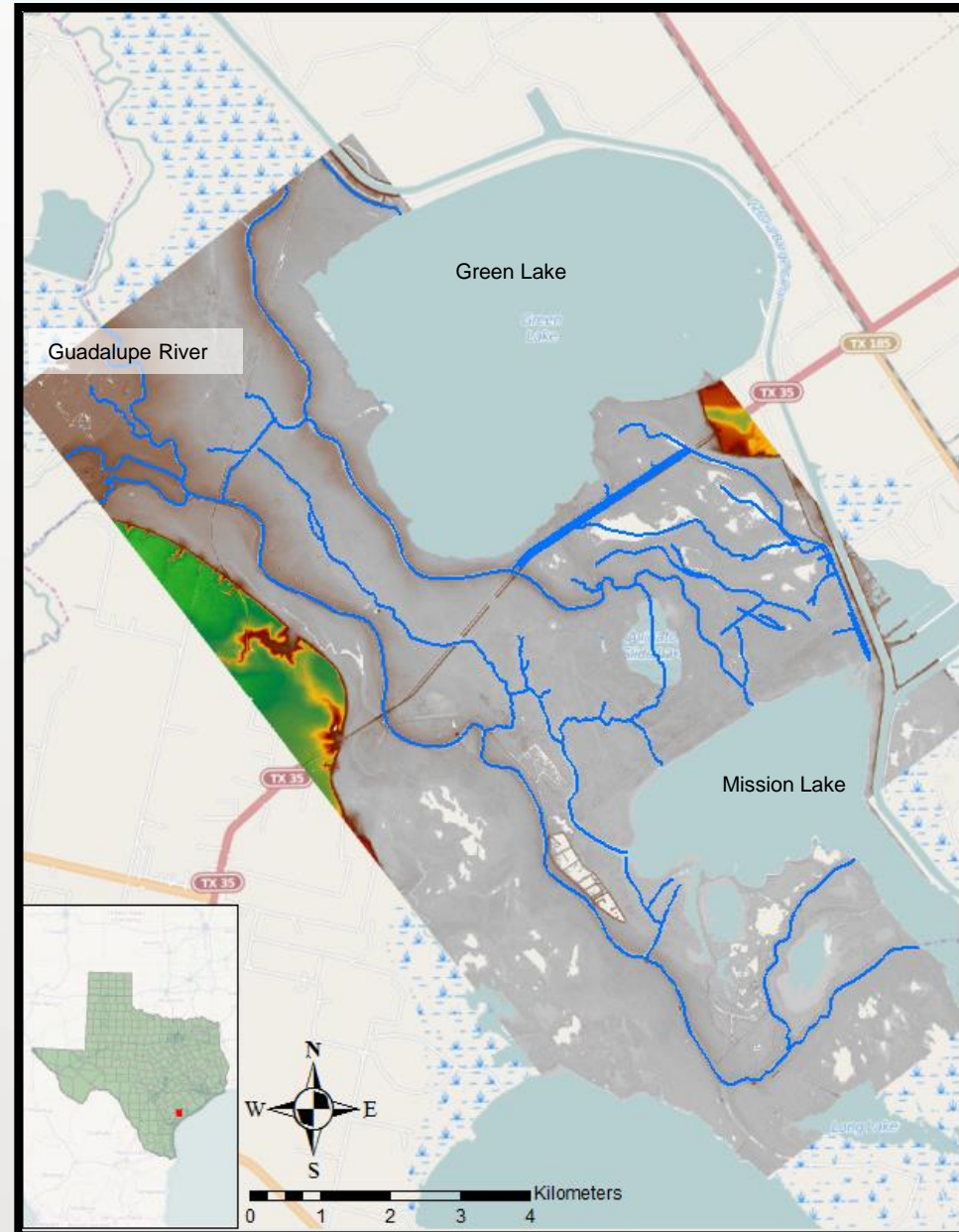


Task 1.2

Identify primary system channelization

Based off manually edited NHD
flow lines, water areas, and water
bodies

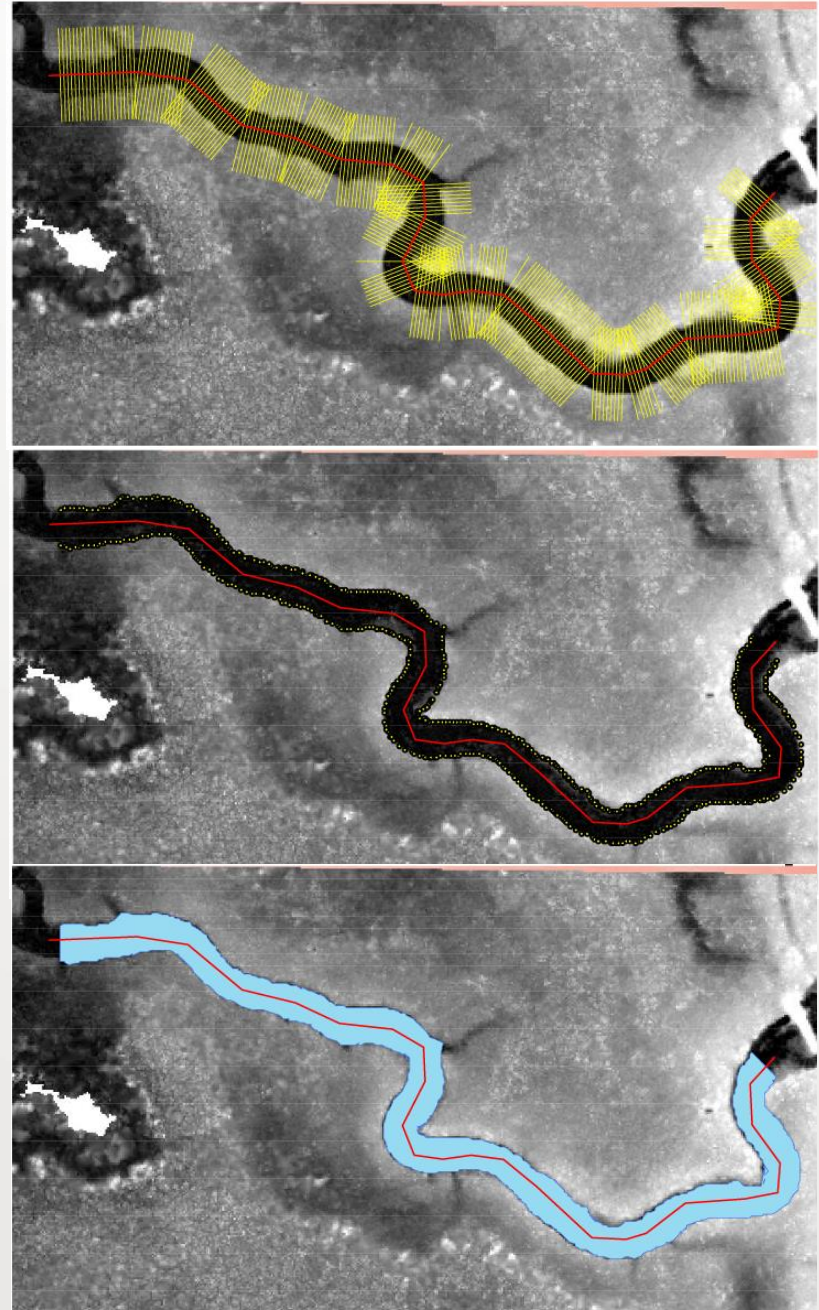
Establishes base level system
connectivities



Task 1.3

Establish maps of current water surface elevations

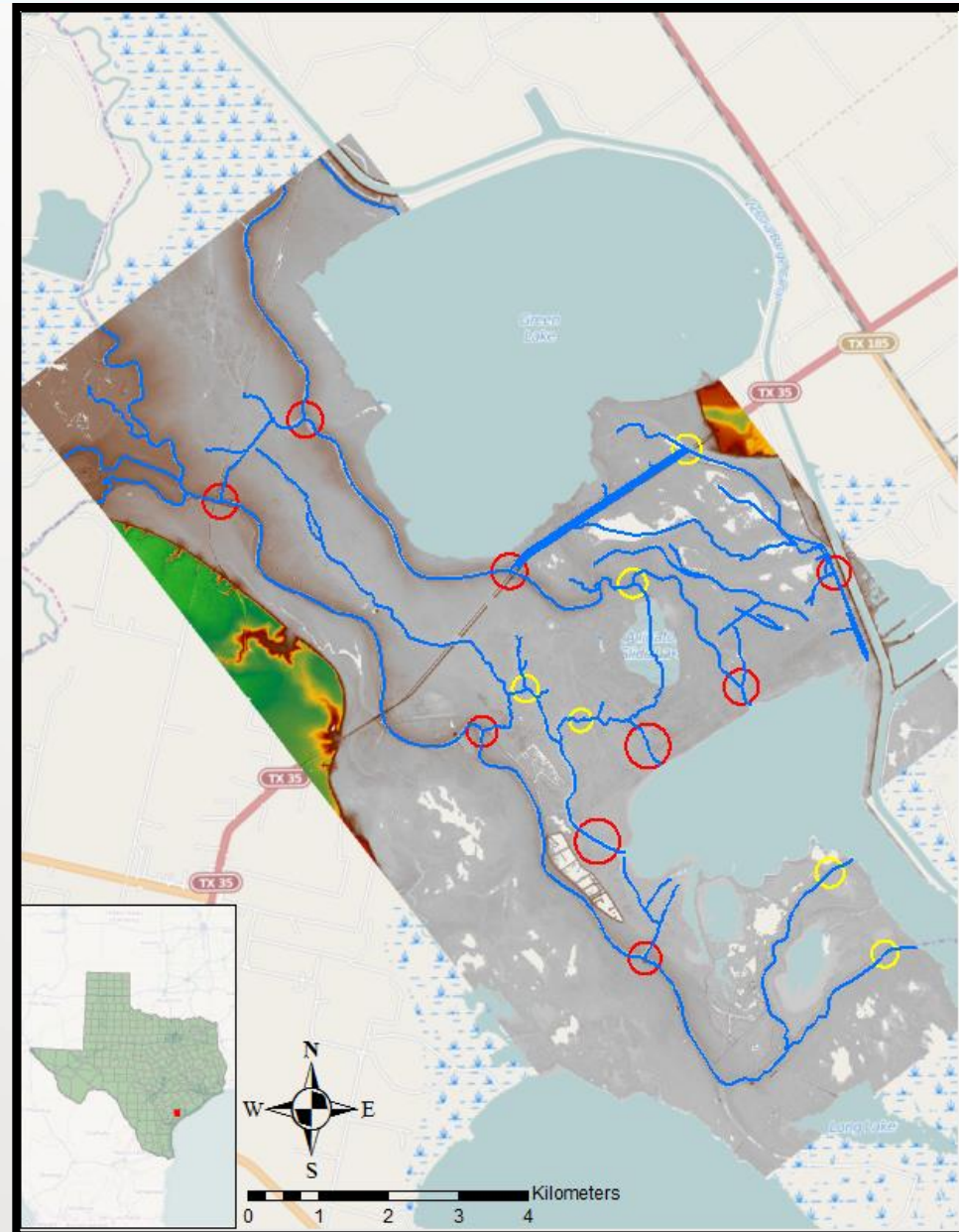
- Continuing, the toolbox
 - Extracts channel centerline
 - Strikes cross sections
 - Identifies bank points in cross sections
 - Extracts bank points
- Bank points can be connected to form a continuous line
- Line can be formed into water surface polygon



Task 2.1

Identify likely sensor locations

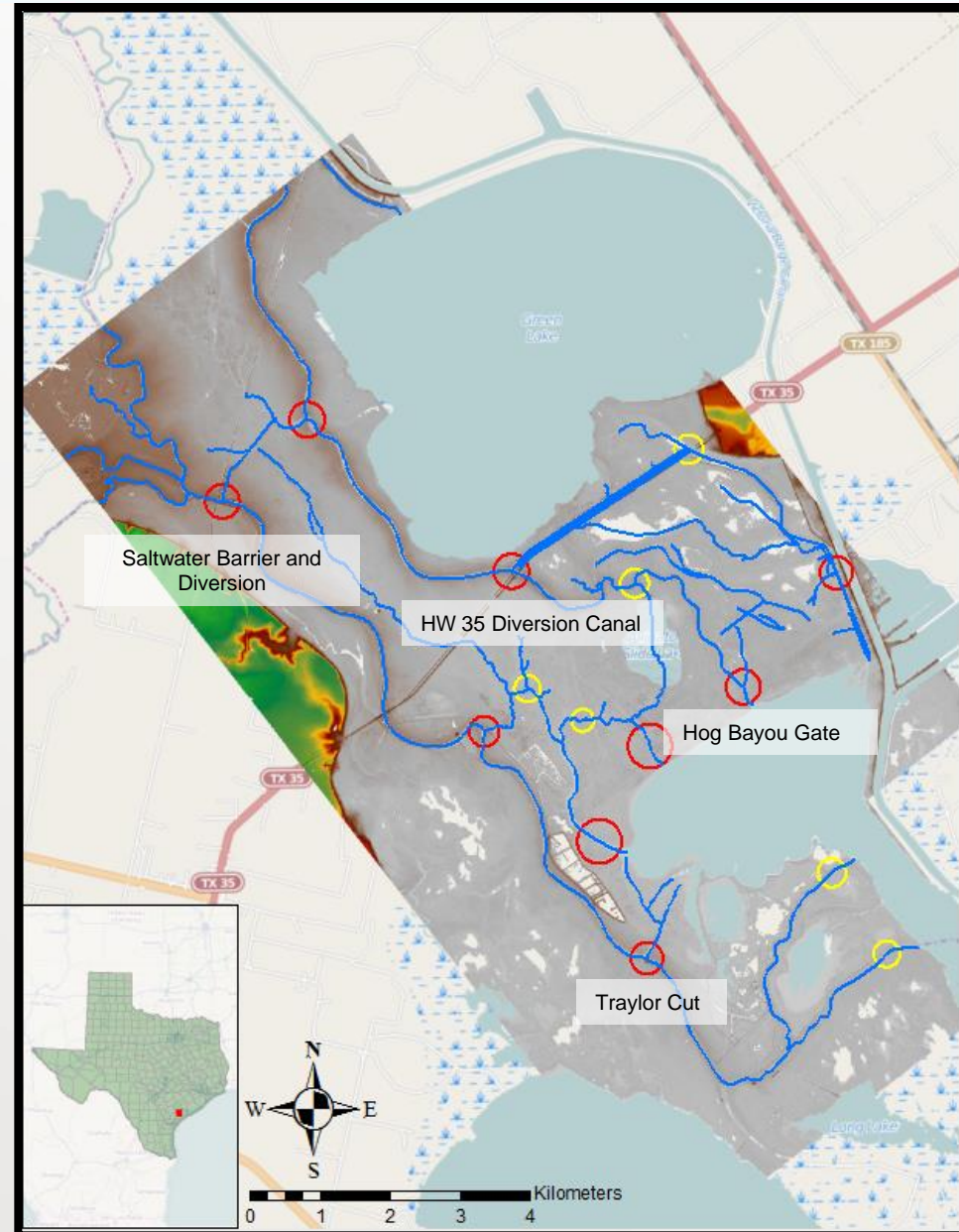
- Locations of secondary interest seen in yellow
- Represent more detailed views of system inputs/outputs and interior system workings



Task 2.2

Perform field reconnaissance

- Initial visit 11/21/2014 guided by Dan Alonso of SABAY
- Established on ground feel for area
- Looked at 4 specific site locations



Task 2.3

Install water level loggers
and CTD sensors

2 field campaigns

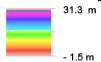
March 2015

Ongoing

Task 2.4

Recover sensors

Guadalupe Delta Lidar



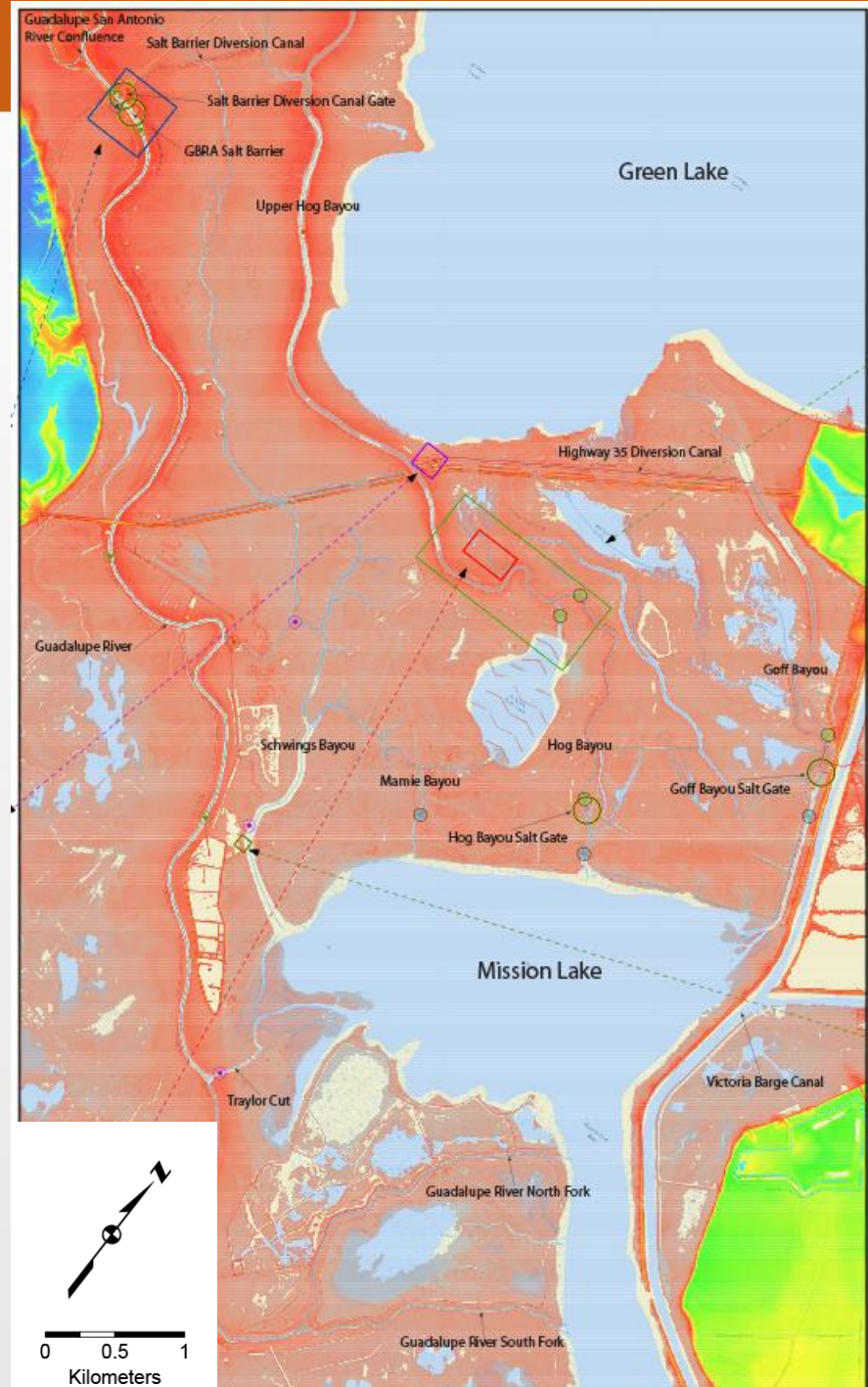
- Modified NHD flowlines
- Freshwater Diversion Canals
- Flow Restrictions

Current Sensor Locations

- ⊗ 10m CTD
- ⊗ 10m TD
- ⊗ 5m TD
- ⊗ Barometer

Future Sensor Locations

- ⊕ 5m TD
- ⊕ 10m CTD

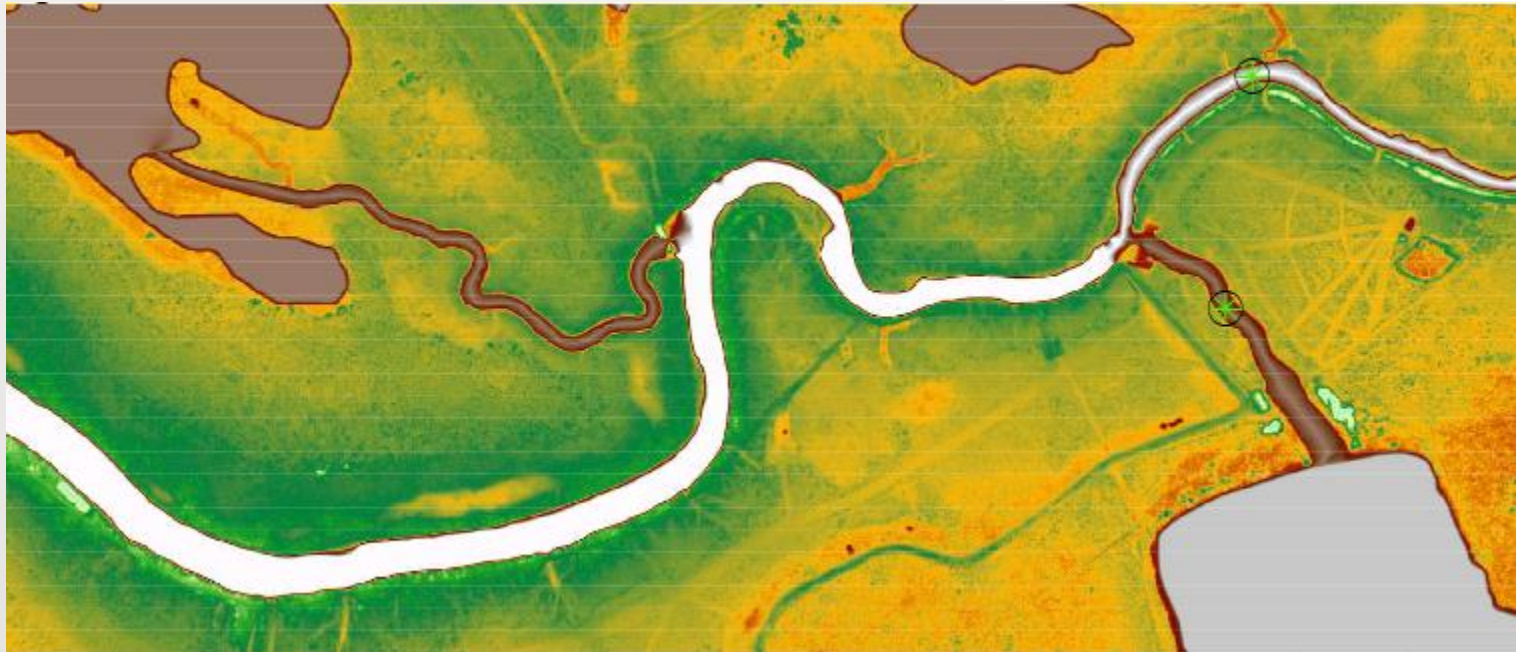
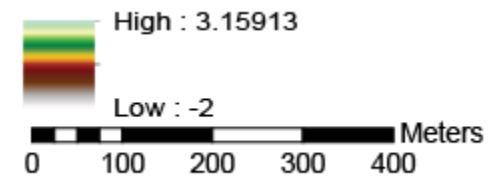


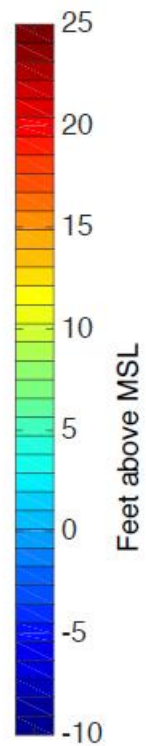
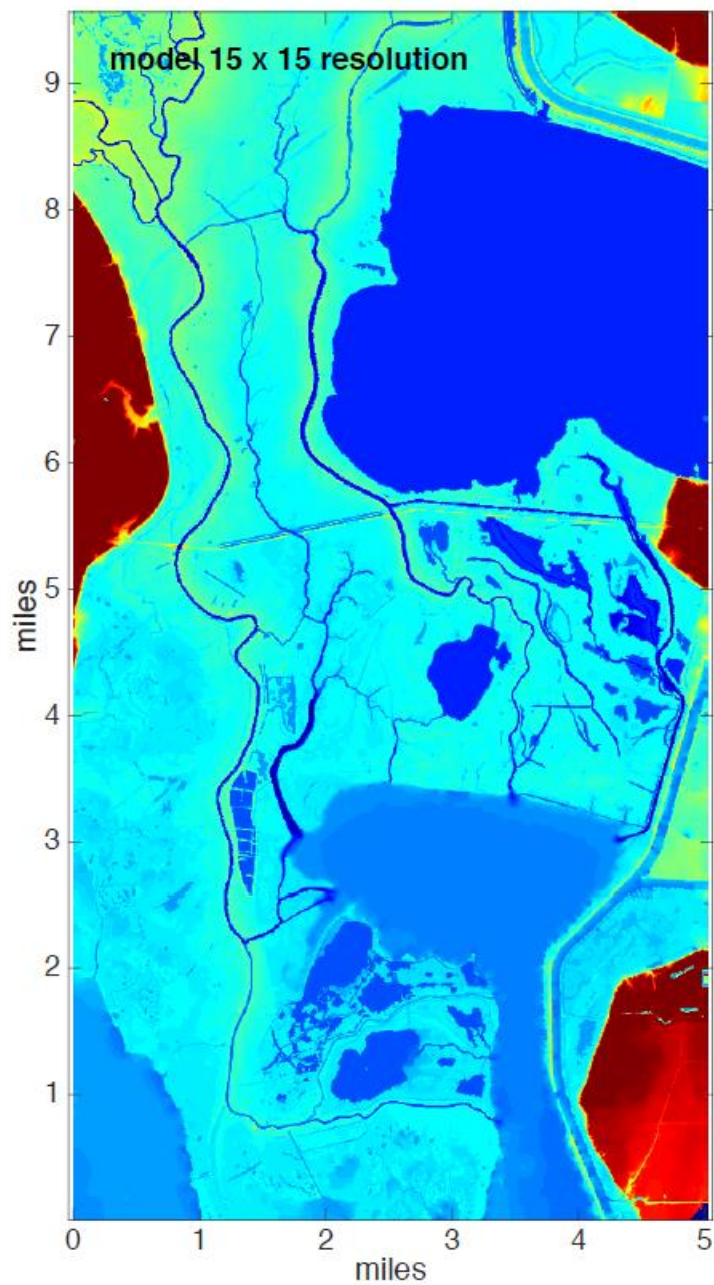
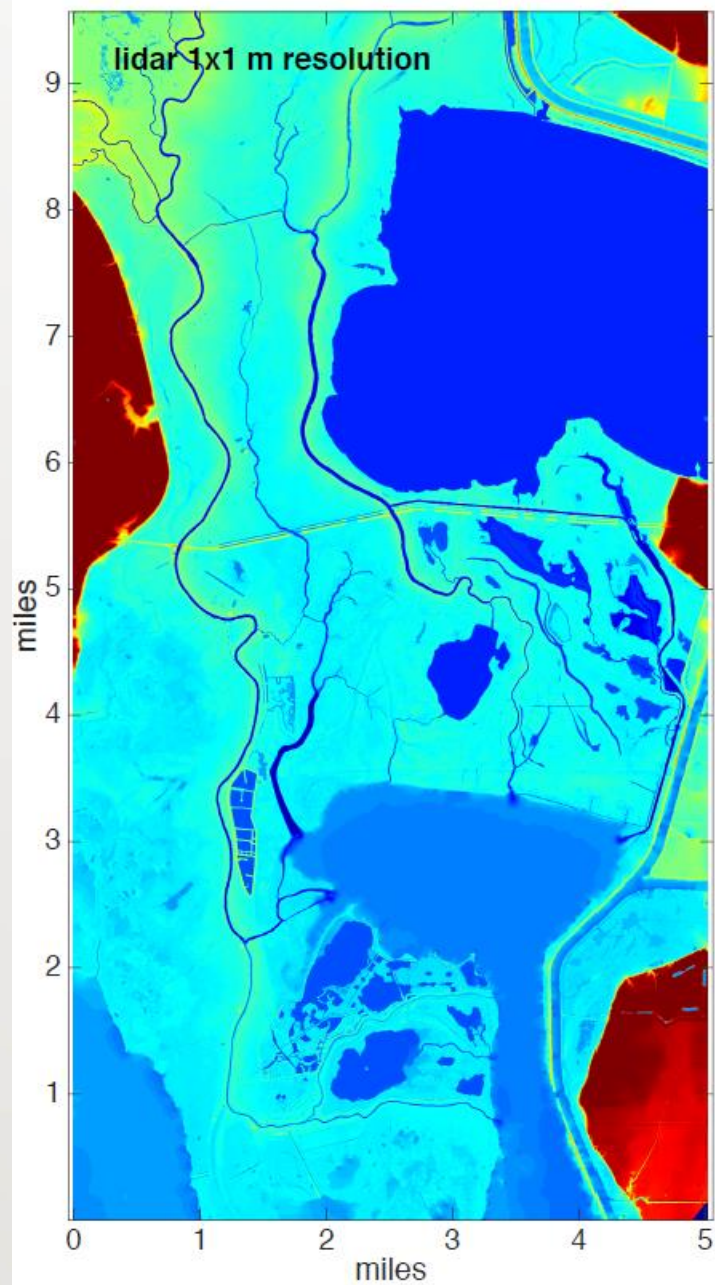
Task 3.1

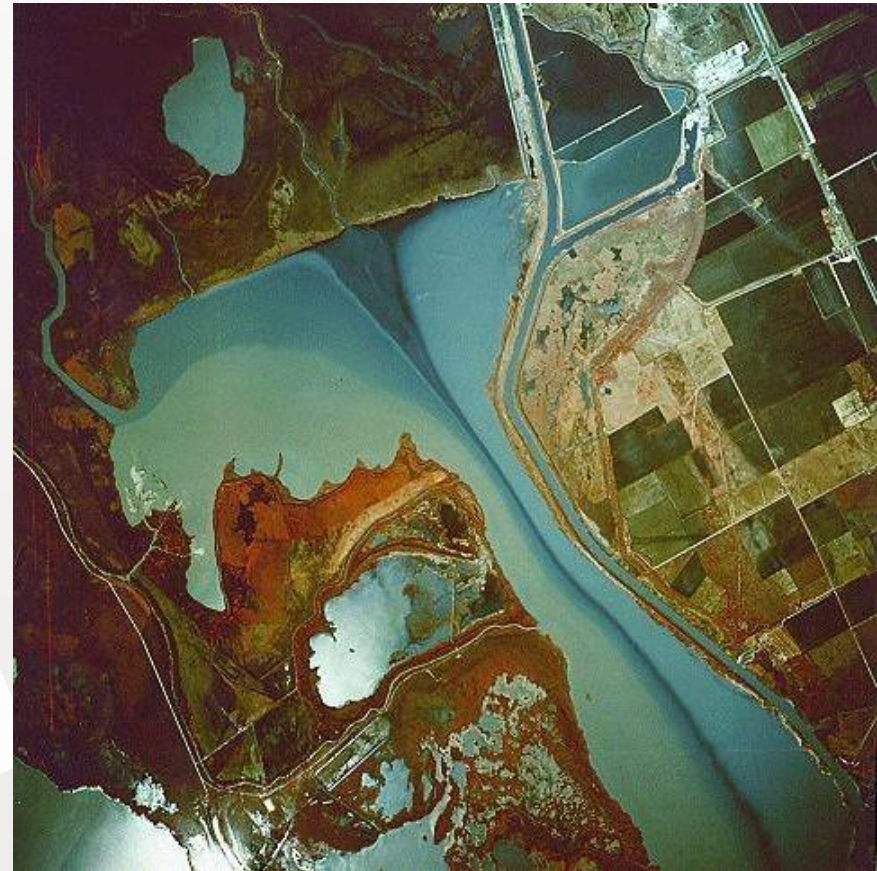
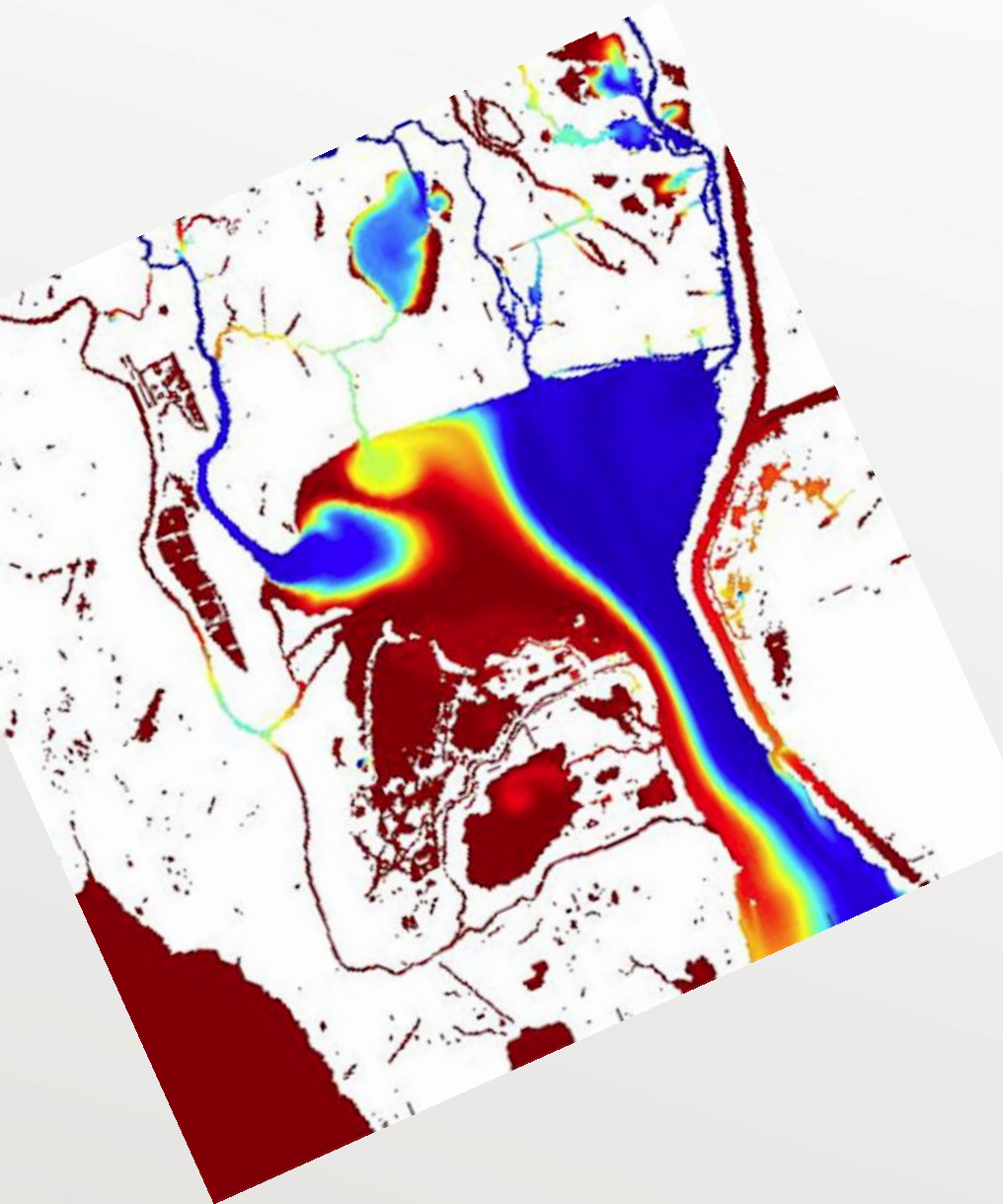
Prepare bathymetry data for model

Water surface extent polygons
removed from the DEM and
replaced by bathymetry

Bathymetric surveys performed by
GBRA along the lower Guadalupe
and the series of diversion canals
Mission Lake bathymetry provided
by TWDB







Project Timeline

Task 1

- Inundation maps: Sept 2014

Task 2

- Field Survey 1 : Sept. 2014
- Field Survey 2: Dec. 2014
- Field Survey 3: Mar. 2014
- Field Survey 4: ongoing (data download)

Task 3

- Model Initialization: Sept. – Dec. 2014
- Model Calibration: Jan. – Mar. 2015
- Model Analysis: Apr. – Aug 2015 **Ongoing**

PROJECT OUTCOMES

Deliverables

Task 1

- Inundation maps of delta system at various depths

Task 2 and 3

- Hydrodynamic model of Guadalupe Delta system

Benefits

Task 1

- Automated, objective, reproducible method for digitizing delta channels covered with aquatic vegetation

Task 2 and 3

- High resolution DEM merged with bathymetric data
- Understanding of water flow through bayous
- Means of estimating effects for changing withdrawal demands

Acknowledgements

Funding provide by BBASC recommendations to TWDB.

We would like to thank numerous personnel within TWDB, GBRA.

Particular help with setting of the field work has been provided by:

Kevin Kriegel, TPWD

Dan Alonso, SABAY

QUESTIONS?

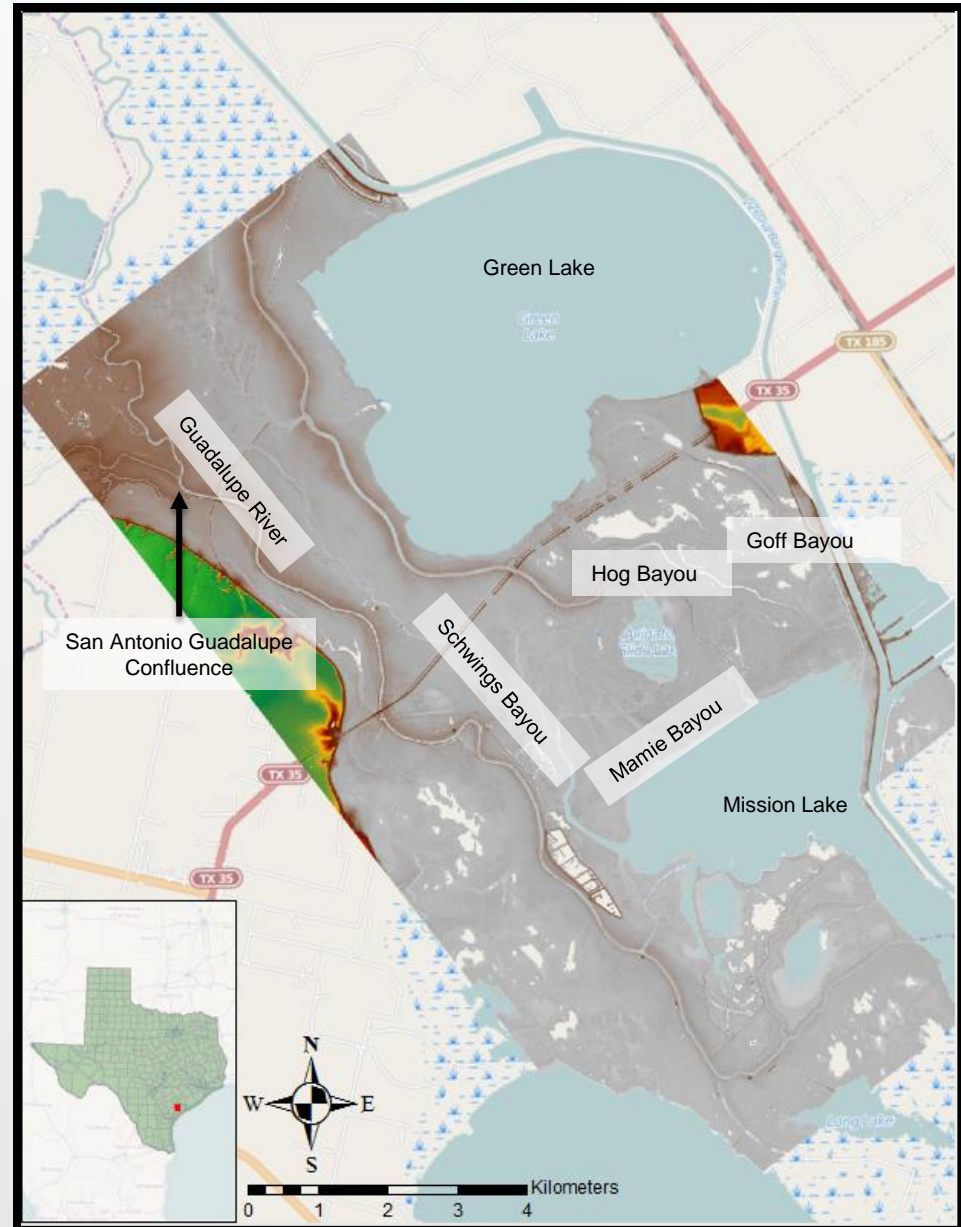
Study Area Location

20 miles southeast of Victoria, TX

10 miles southwest of Port Lavaca

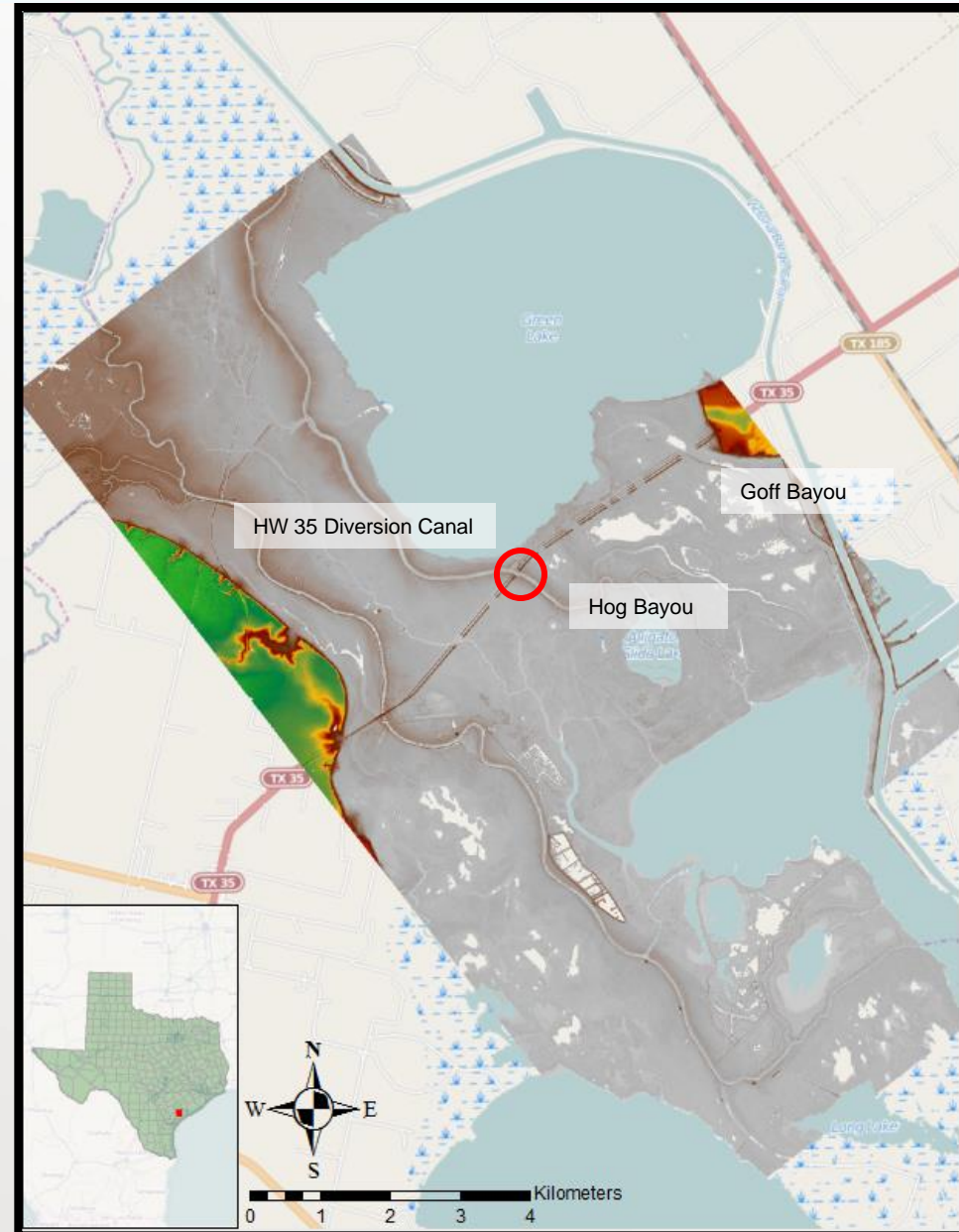
Region south of the Guadalupe San Antonio
River confluence to discharge at Mission Lake

Special interest in understanding flows
through 4 bayous within the Guadalupe
Wildlife Management Area



HW 35 Diversion Canal

Diverts water from Hog Bayou to
Goff Bayou for industrial use



HW 35 Diversion Canal 01/2013



Upstream



Downstream

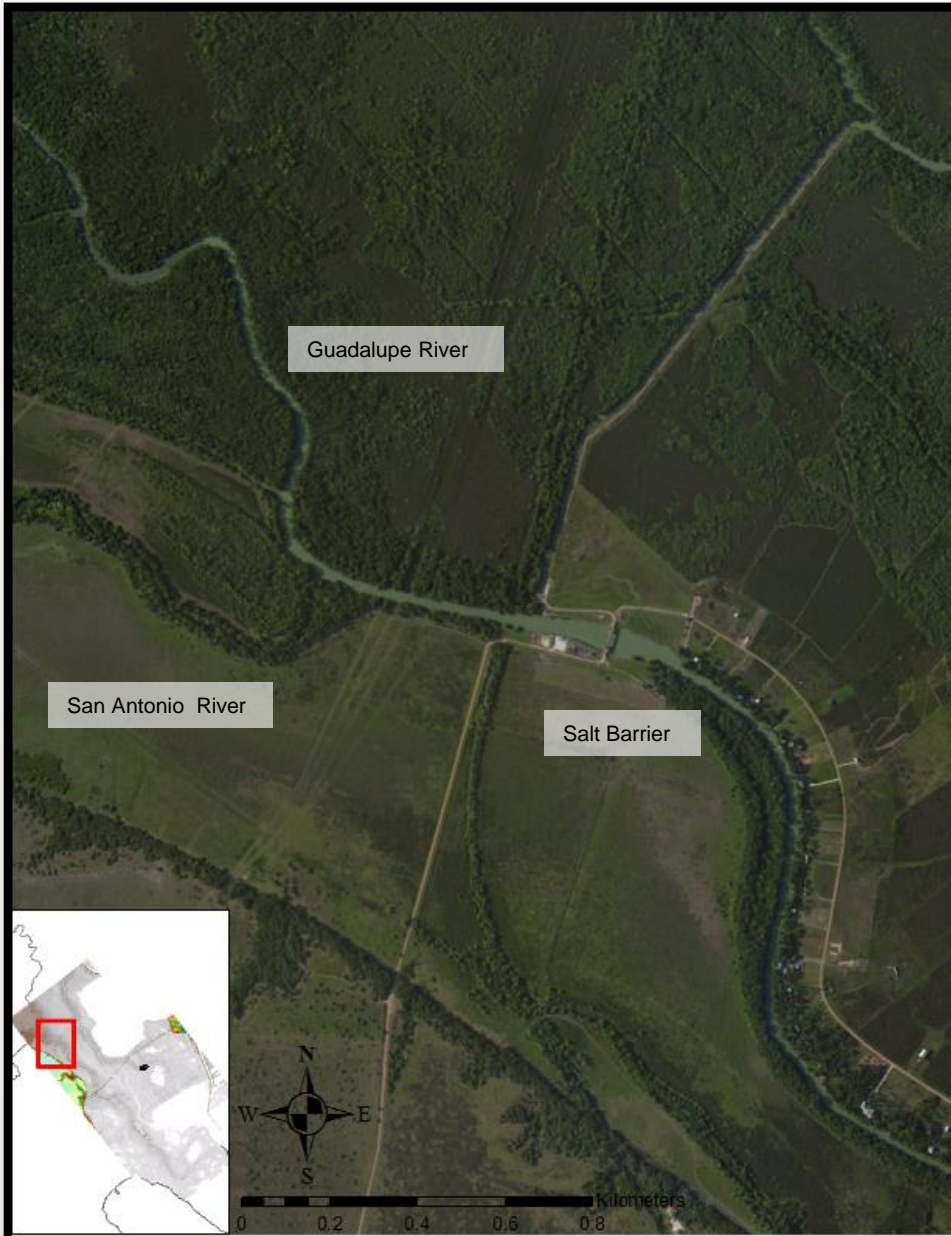
HW 35 Diversion Canal 11/2014

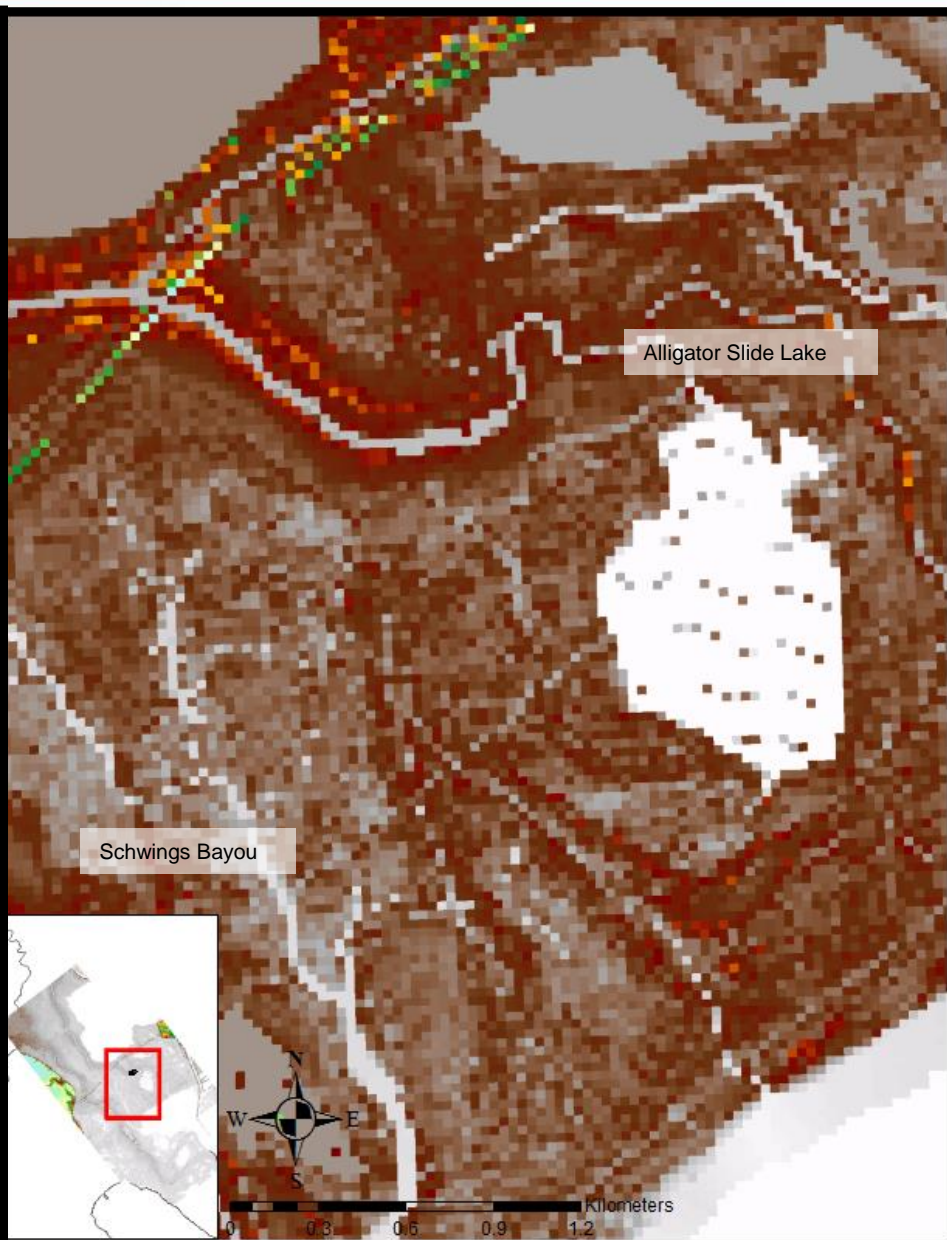
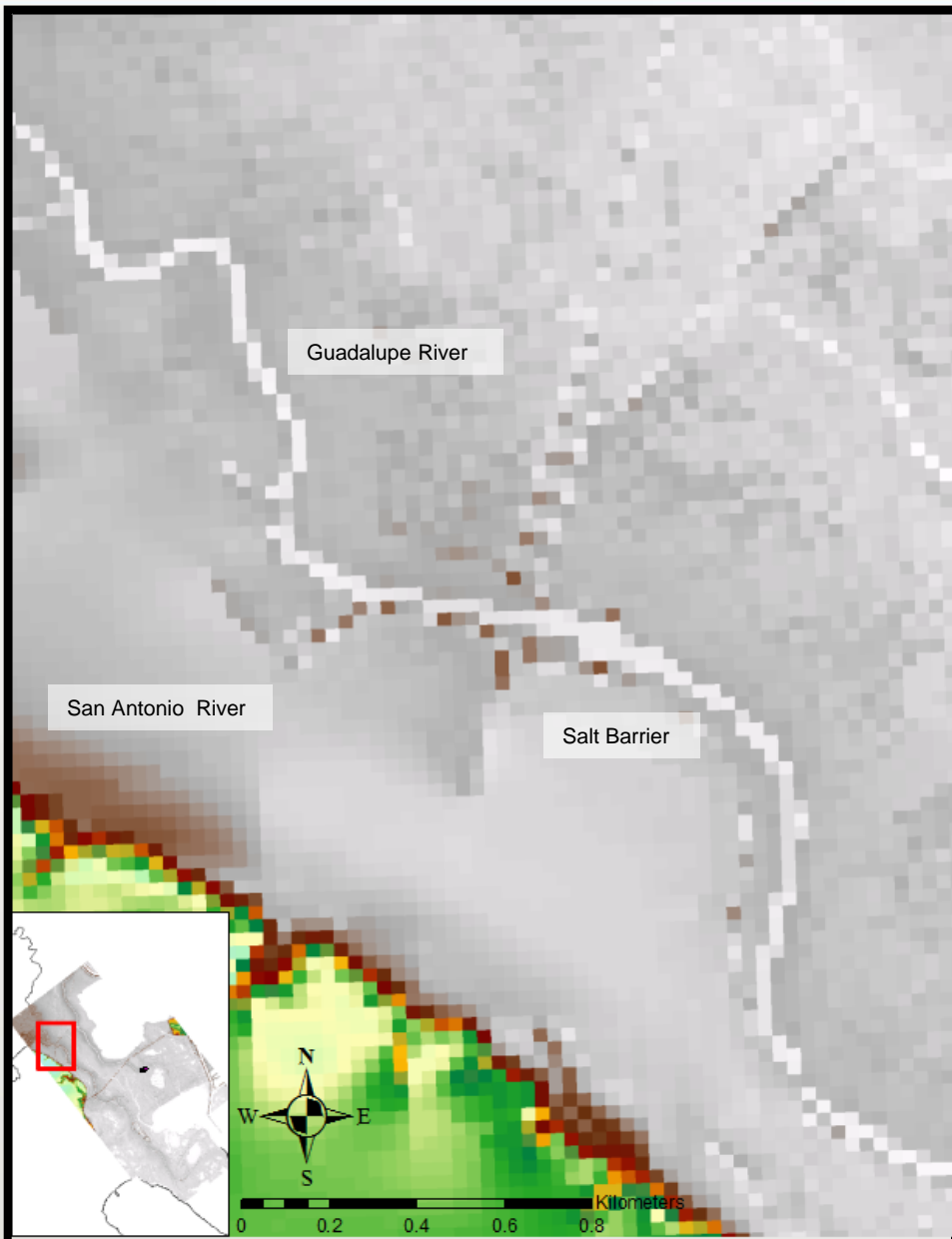


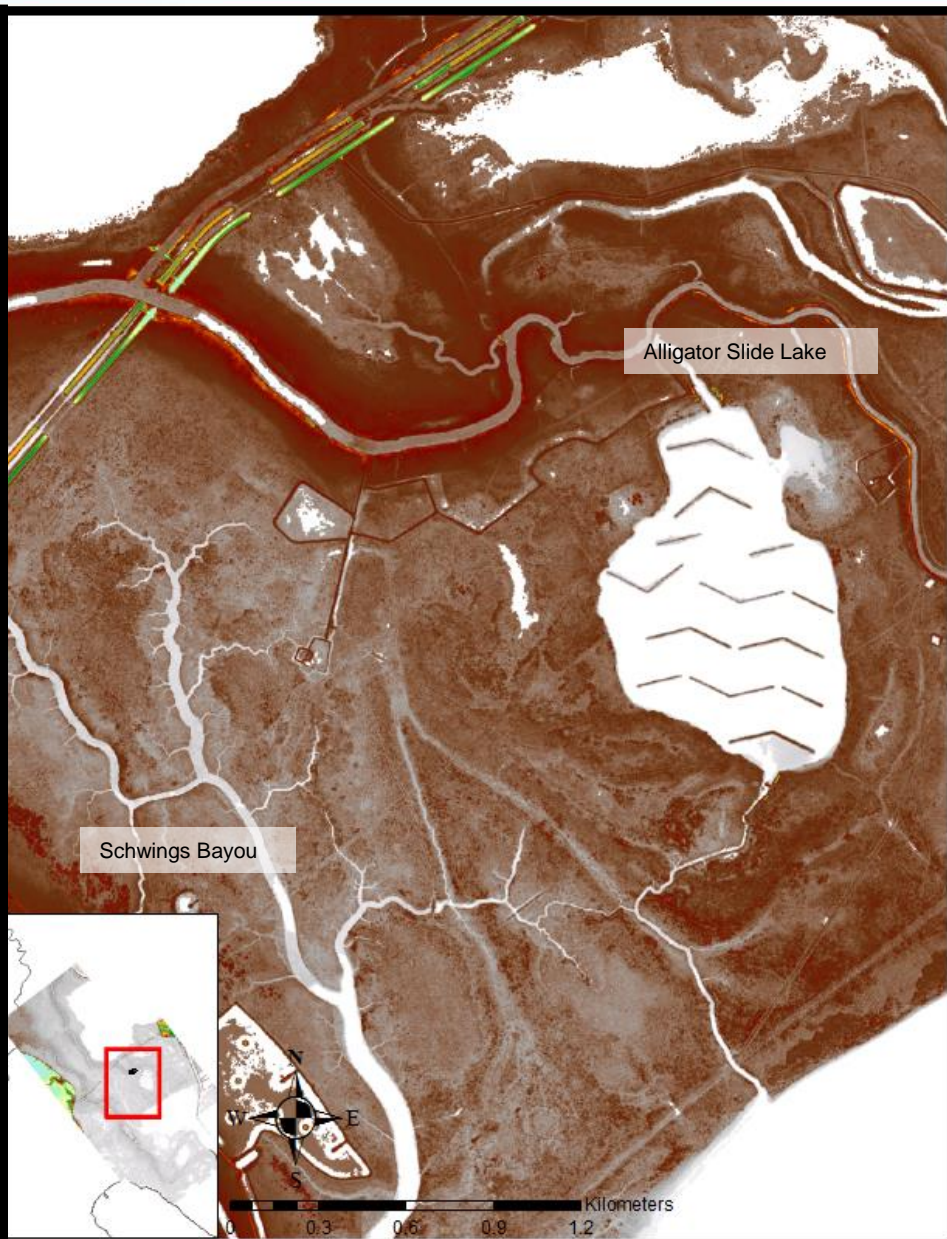
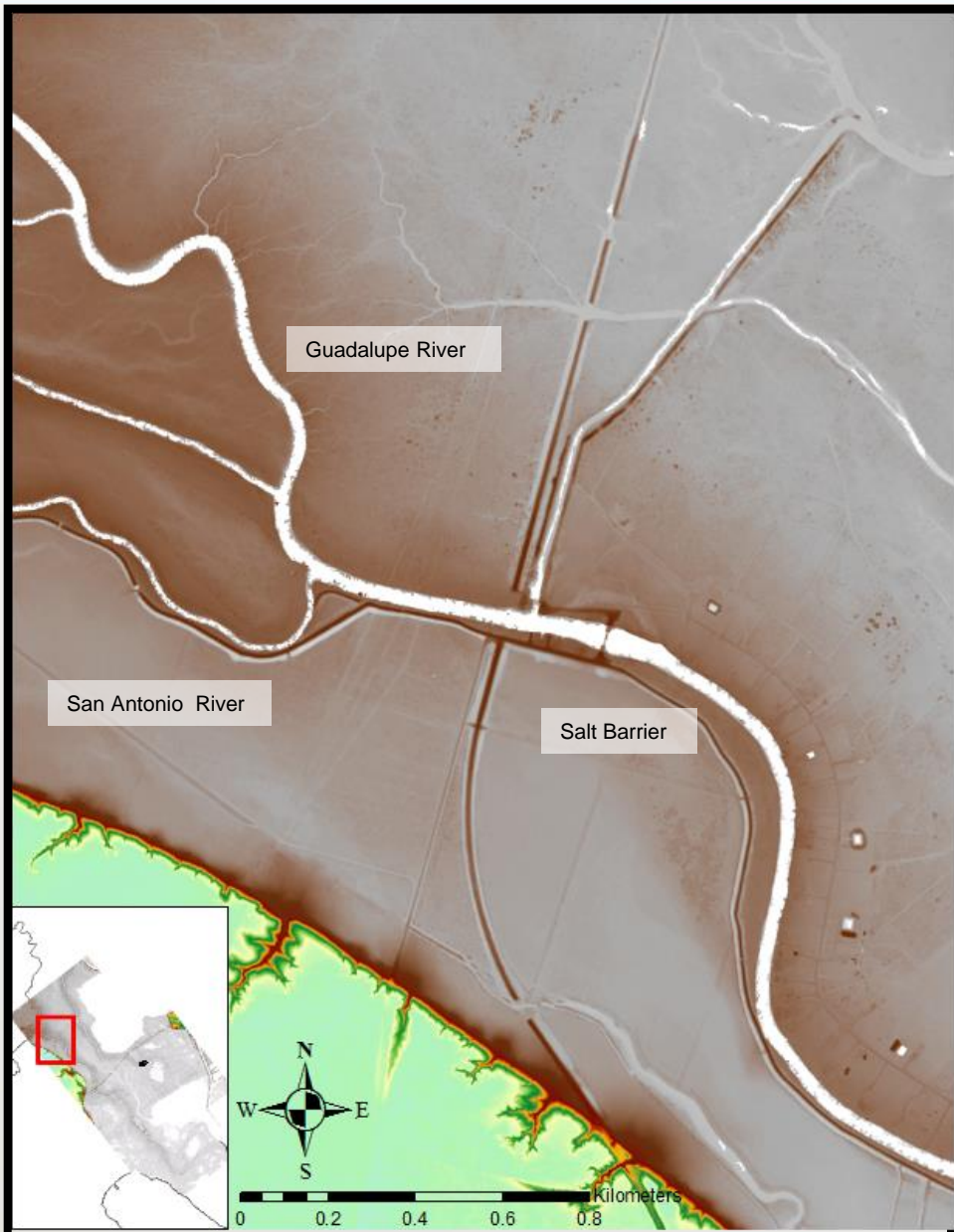
Upstream



Downstream







Lidar and Water Surfaces

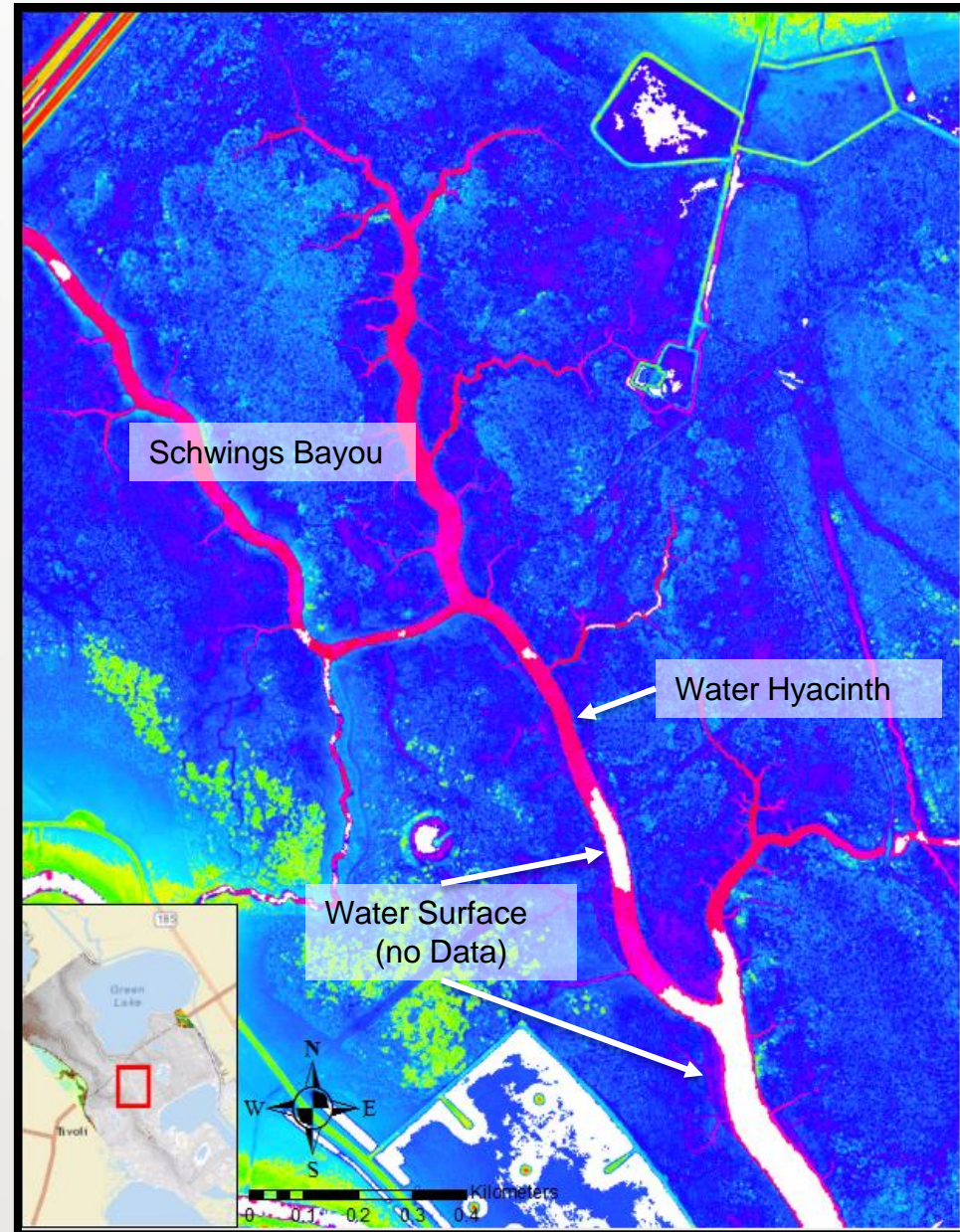
Light Detection and Ranging

Lidar returns no data when encountering water surfaces

Convenient identification of water

Pervasive aquatic vegetation (water hyacinth) masks water surface

Channels identified easily visually, but automated extraction difficult



Lidar and Water Surfaces

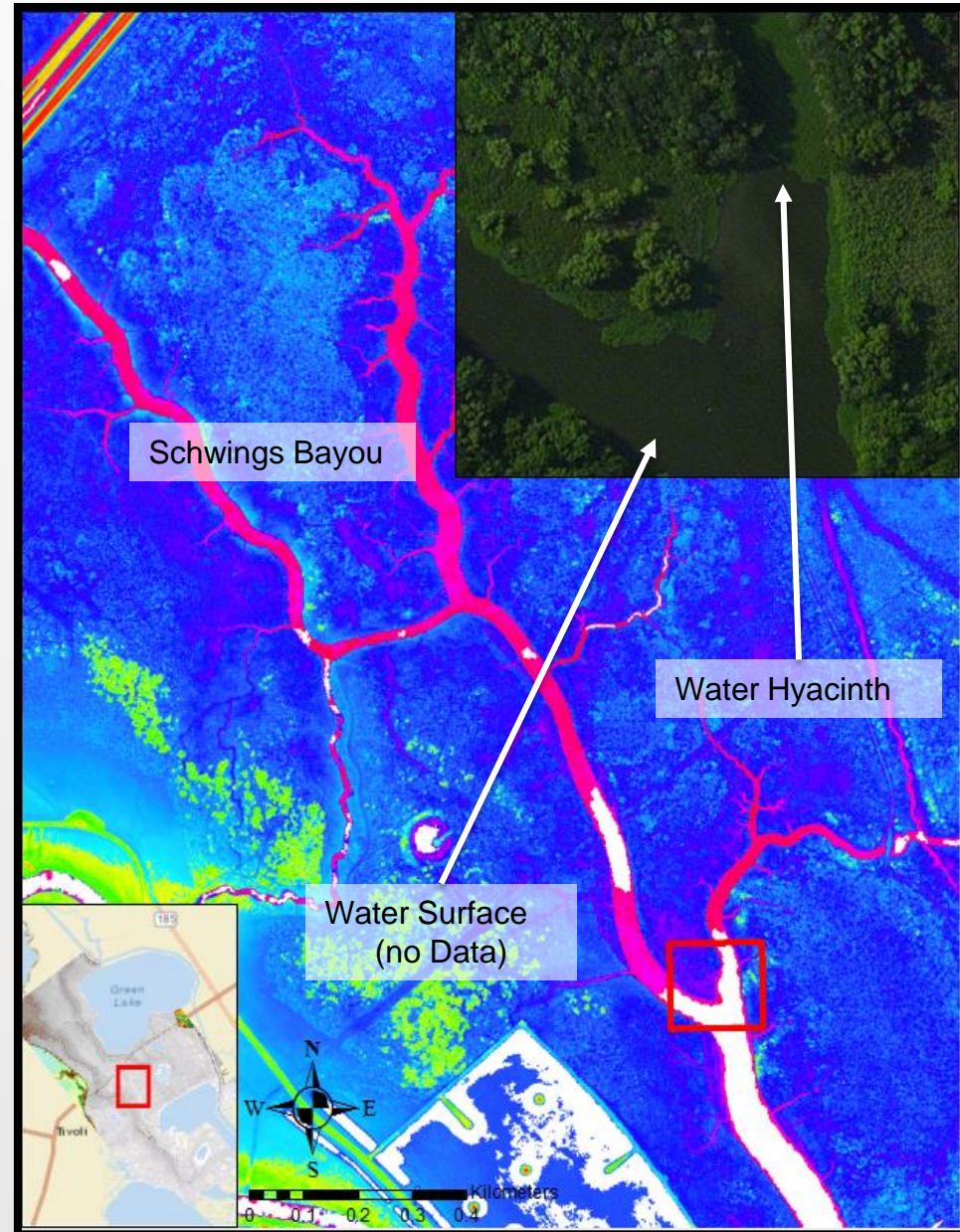
Light Detection and Ranging

Lidar returns no data when encountering water surfaces

Convenient identification of water

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Task 1.3

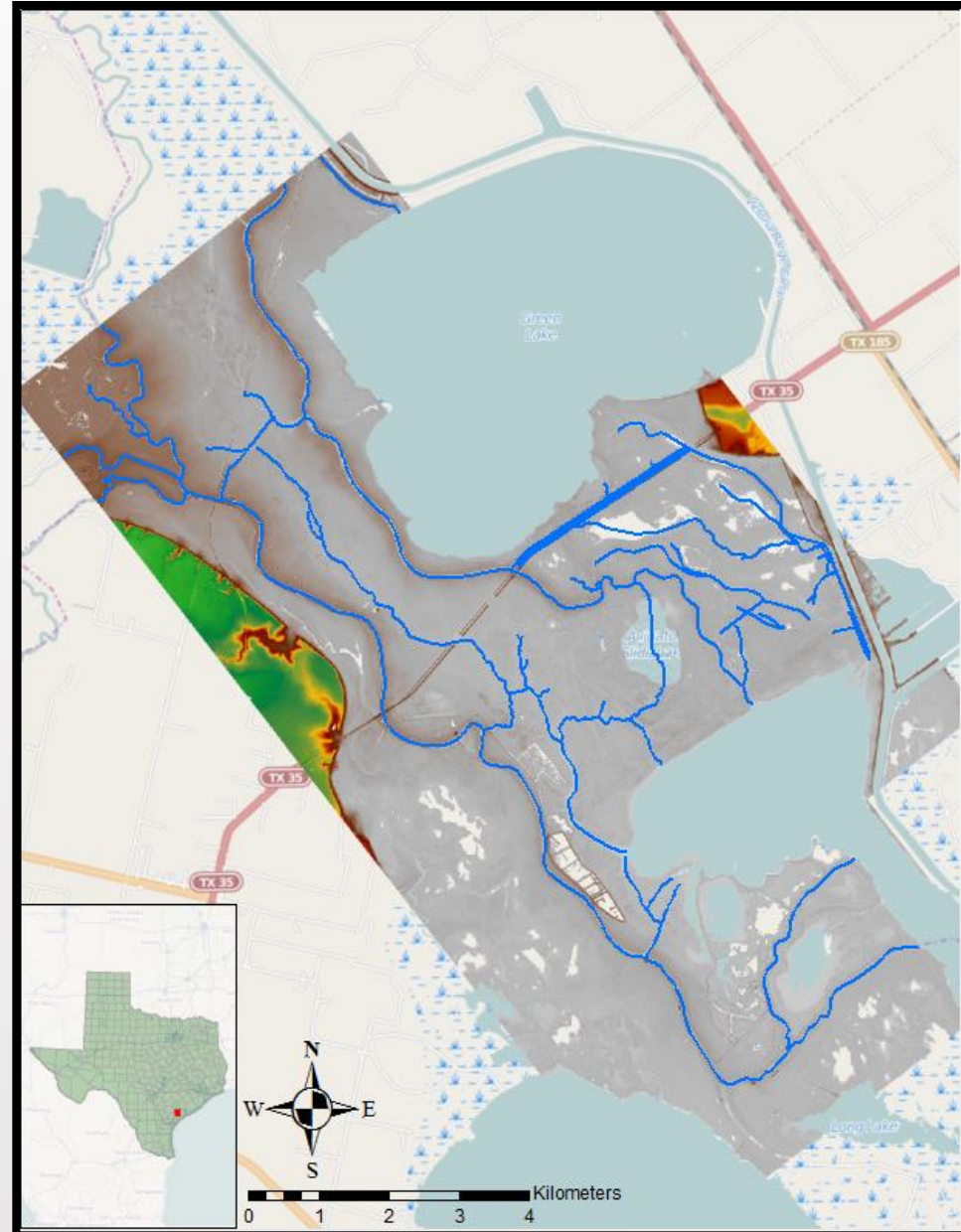
Establish maps of current
water surface elevations

Mapping channel extents difficult
due to hyacinth masking water as
terrain

Manual water surface mapping
possible, but there are numerous
downsides

- Time consuming
- Subjective
- Not reproducible

Automated (or semi-automated)
provides solutions to each of these
problems

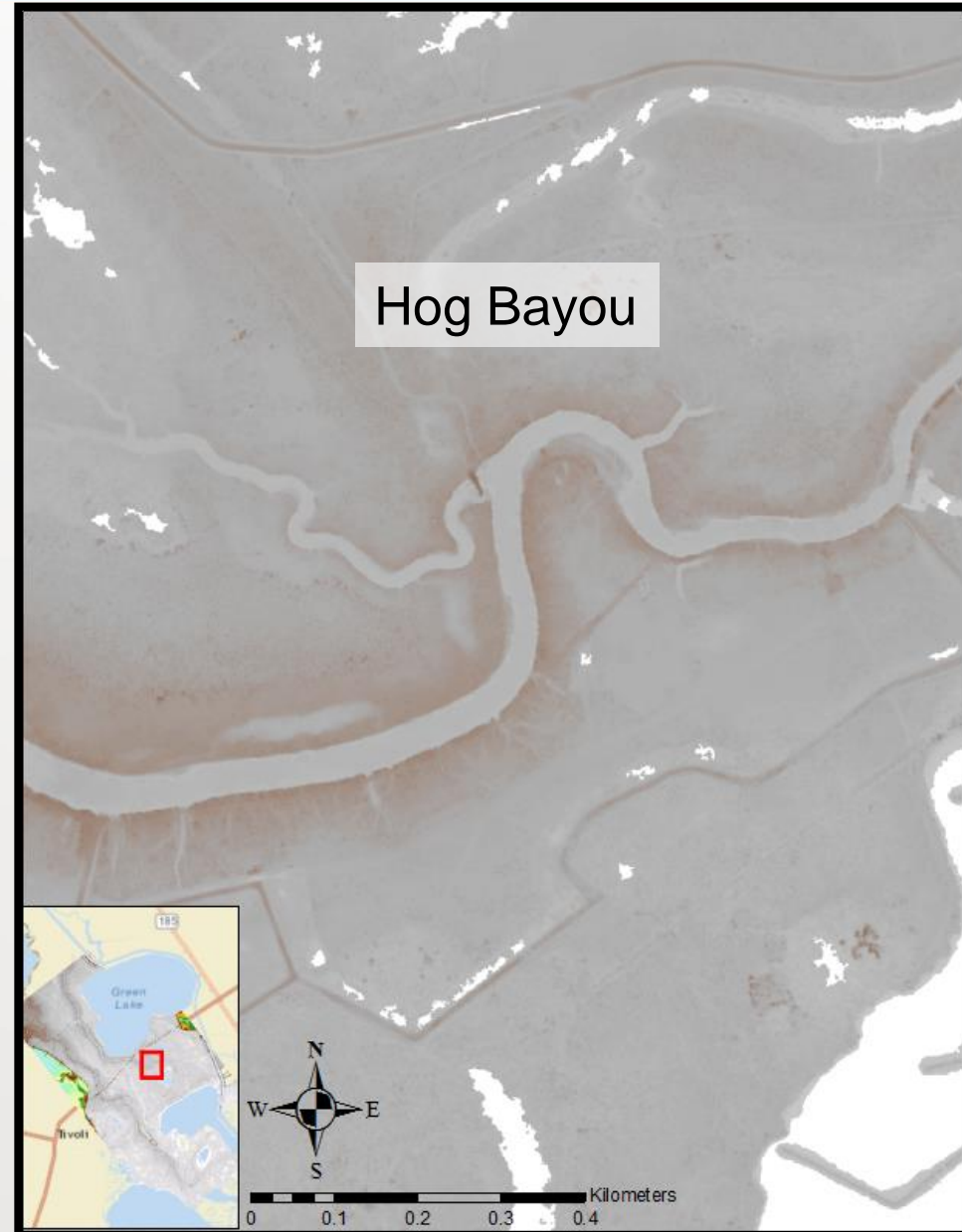


Task 1.3

Establish maps of current
water surface elevations

Automated solution, GeoNet2.0
feature extraction toolbox

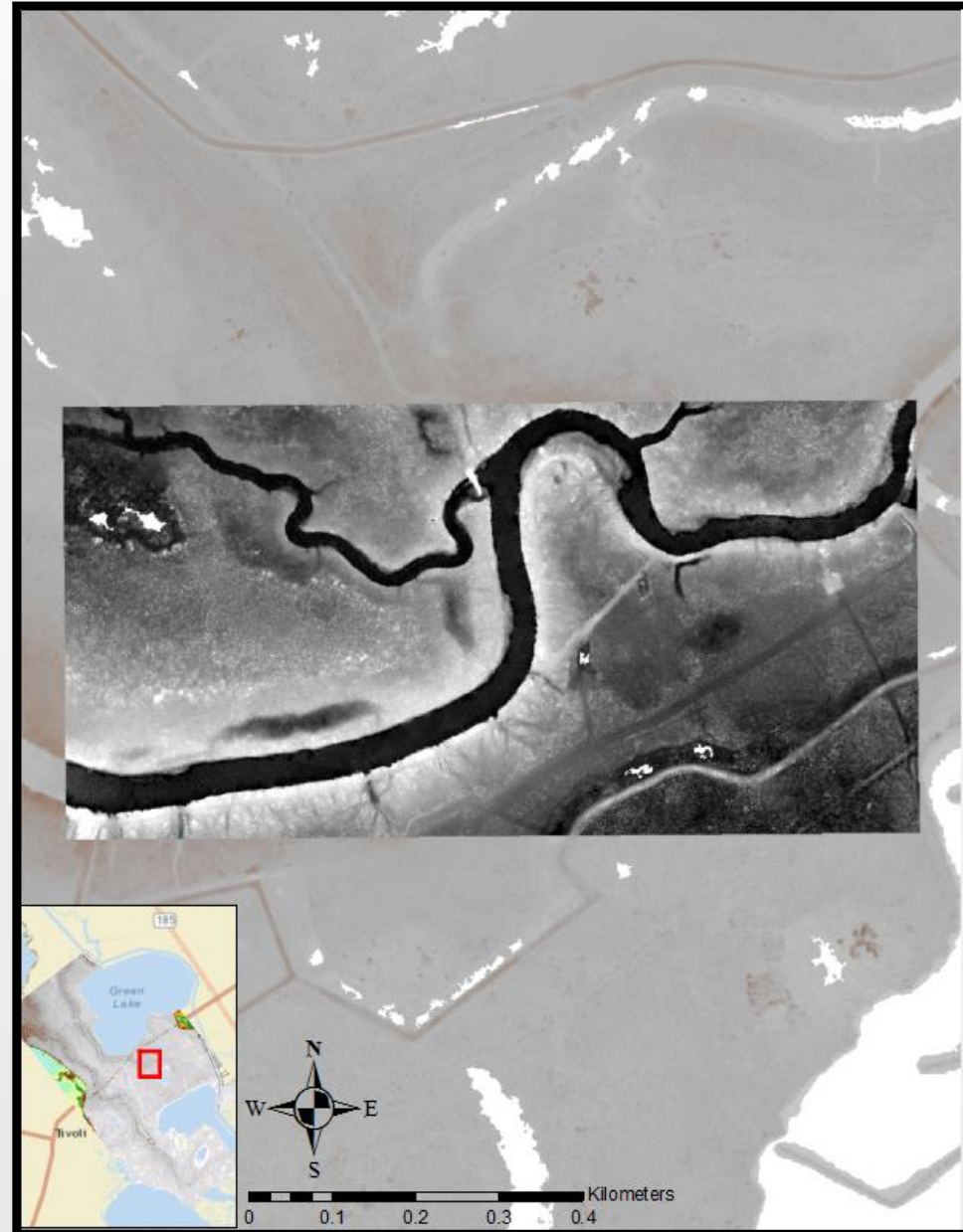
Sample study on hyacinth covered
reach of Hog bayou just above
Alligator Slide



Task 1.3

Establish maps of current
water surface elevations

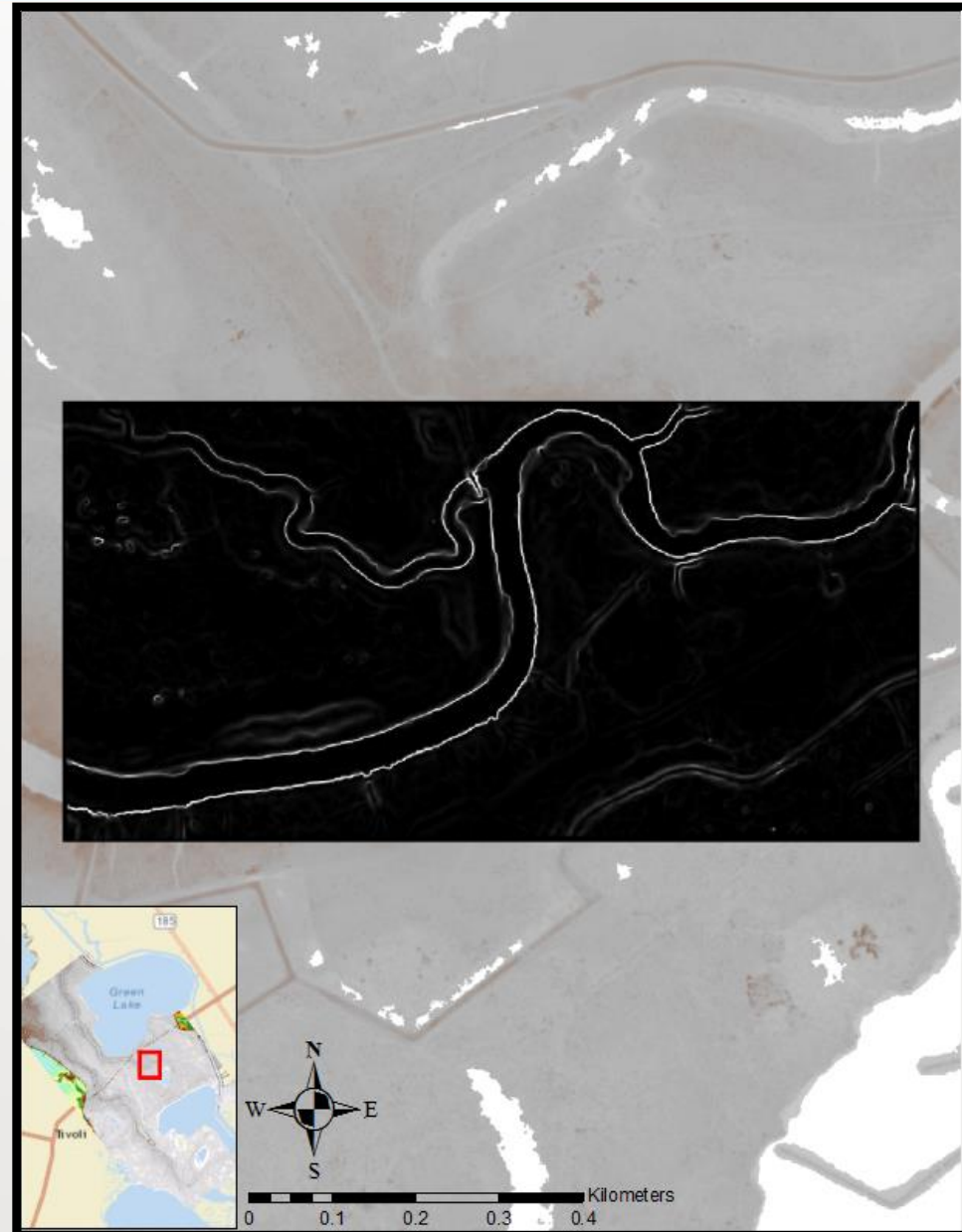
Import tiff to GeoNet2.0



Task 1.3

Establish maps of current
water surface elevations

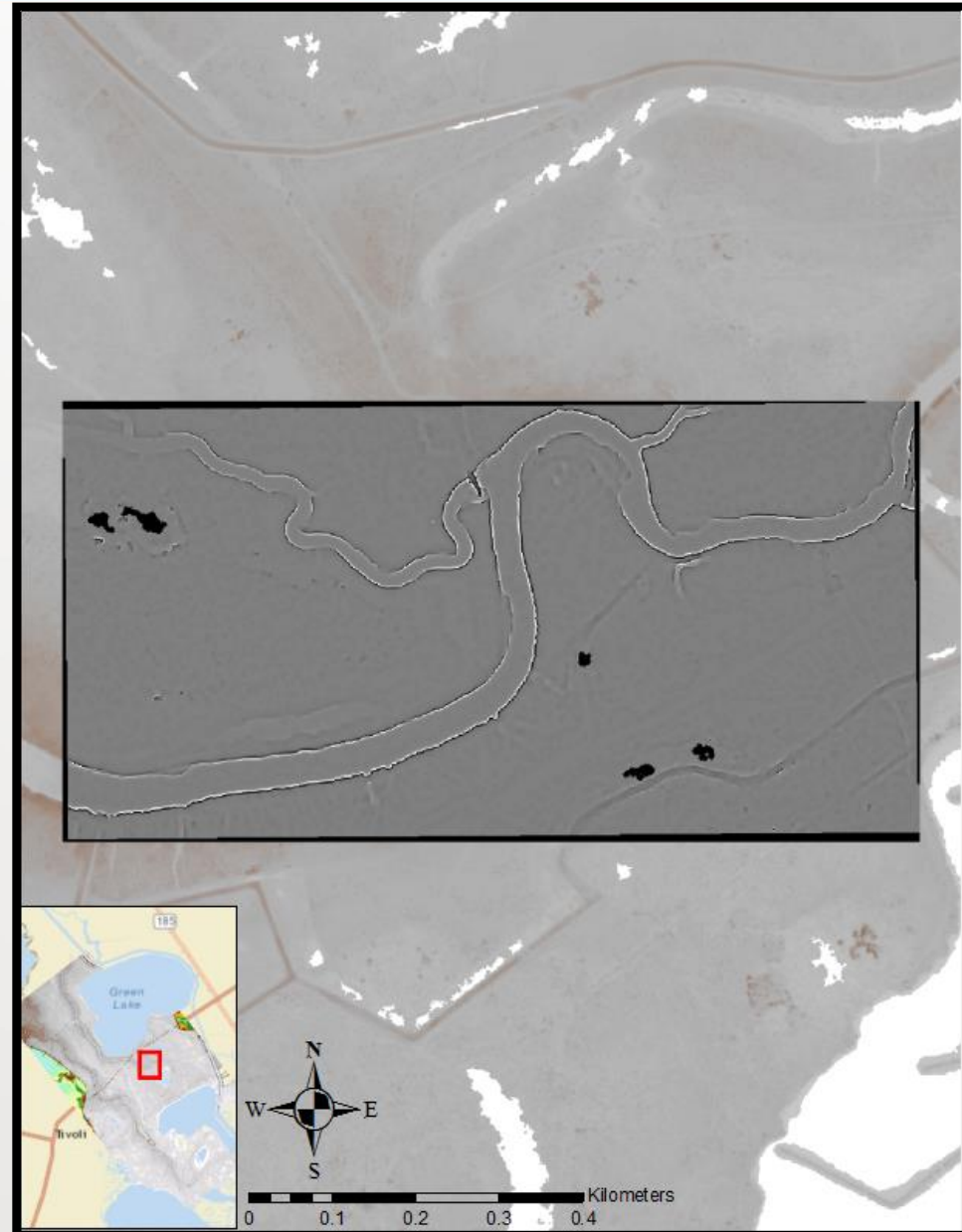
- Import tiff to GeoNet2.0
- GeoNet2.0
 - Extracts terrain slope



Task 1.3

Establish maps of current
water surface elevations

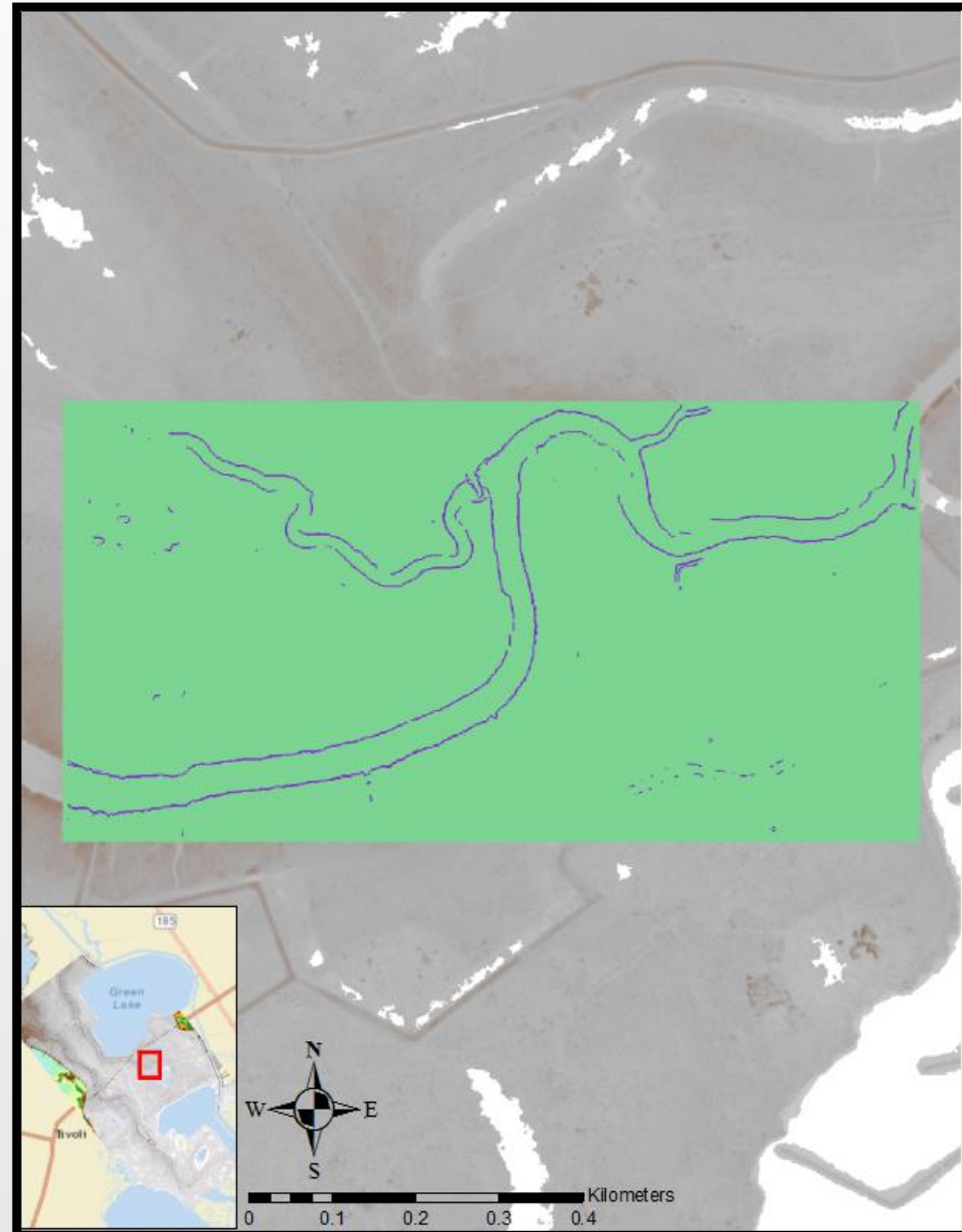
- Import tiff to GeoNet2.0
- GeoNet2.0
 - Extracts terrain slope
 - Determines convergent zones based on curvature



Task 1.3

Establish maps of current
water surface elevations

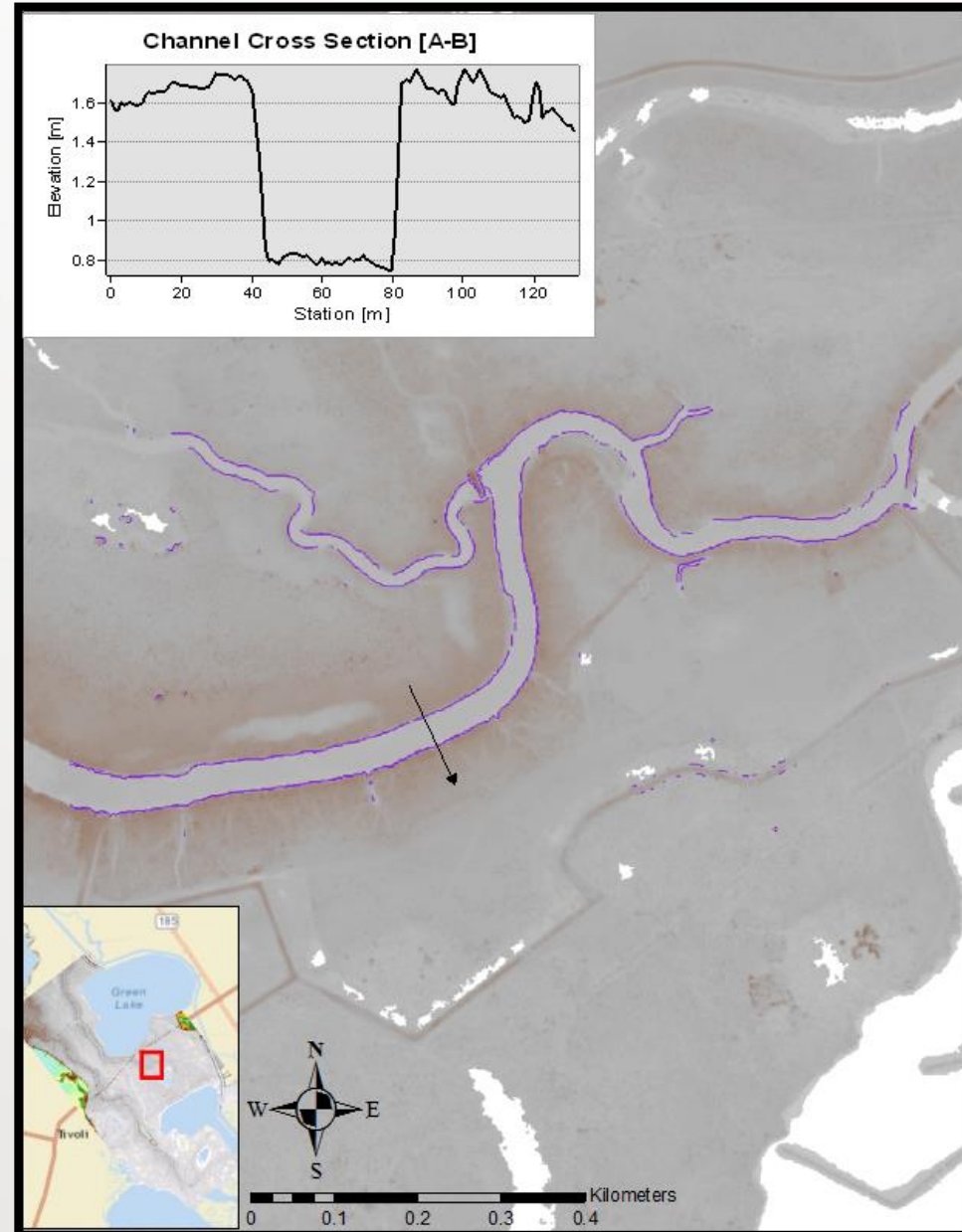
- Import tiff to GeoNet2.0
- GeoNet2.0
 - Extracts terrain slope
 - Determines convergent zones based on curvature
 - Determines likely bank locations



Task 1.3

Establish maps of current water surface elevations

- Import tiff to GeoNet2.0
- GeoNet2.0
 - Extracts terrain slope
 - Determines convergent zones based on curvature
 - Determines likely bank locations
 - Identified bank edges show good agreement visually



Task 1.3

Establish maps of current
water surface elevations

- Continuing, the toolbox
 - Extracts channel centerline

